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ABSTRACT

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A Detailed Study of the Learning Behaviors of In-service Teachers Learning To Use Two New Models of Teaching

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The major objective of this study was to observe the learning behaviors of teachers selected by their school districts to attend a training institute to learning some new ways of teaching. The teachers expected to use these new ways of teaching themselves and also to conduct training for other teachers in their own districts. This presentation describes the general and metacognitive behaviors of 12 teachers over an eight-month period as they learned to teach in new ways, using the concept attainment and synectic teaching models. The cognitive behaviors teachers reveal while learning to use these models of teaching are also described in an exploration of the possible differences in learning strategies displayed by teachers who learn to use the new models successfully and those who do not do so.

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Introduction

Canadians and Americans consider their educational systems very important to the future of their nations. In spite of marked changes in society and the increased availability of information during the last two or three decades, Goodlad (1984) reports that education in classrooms has not changed greatly from earlier years. Recitation is still the predominant mode of instruction and the textbook remains as the main source of information.

In spite of this, many educators are writing modern goals and objectives of education which place increasing emphasis on active learning by students. This view is fuelled by the work of cognitive psychologists, as they try to understand and explain what goes on inside people's heads as they learn. Studies show that a variety of learning strategies exist and that "good learners" knowingly employ efficient behaviors, for example in problem-solving or remembering, and that these strategies can be taught to other learners with some success (Bransford et al. 1982).

These ideas have implications for education in the classroom which, if accepted and implemented, hold consequences for the training of teachers who will have to adopt some different ways of teaching their students.

Several educators have designed teaching strategies for developing different learning outcomes such as inductive thinking, creative thinking and improved communication skills. Each strategy creates a different learning environment in which teachers and students have specific roles and activities to perform during phases which sequentially lead to the fulfillment of the planned learning objectives.

Many of these strategies are described in Models of Teaching (Joyce and Weil, 1986). These models of teaching form the basis for a wide repertoire of teaching behaviors available for teachers willing and able to use them in their classrooms.

Training programs have been developed to help teachers learn how to use new models of teaching. A strong training is believed to consist of theoretical instruction, demonstration by trainers, practice by teachers among their peers with objective feedback based on the phases of the models, followed by coaching during an implementation and practice period as the teachers try their new skills in their classroom activities (Joyce and Showers, 1983).

Many teachers attend workshops and training sessions, and are frequently sponsored by their school districts who hope that these teachers will serve as leaders for change in the classrooms. However, it is well-known that planned curriculum change is often not fully implemented in the schools, and Showers (1983) reported that many teachers who have experienced training have failed to transfer the newly learned teaching strategies to their classrooms. Showers reported that teachers who were successful appeared to develop their own understanding of the strategies, their use and application through frequent practice.

No study has examined in detail the different learning behaviors of teachers trying to use new models of teaching to describe possible differences in learning behaviors and strategies between teachers who do use the new models successfully and those who do not do so. Fogarty, Wang and Creek (1984) described the thinking and behavior of experienced

and novice teachers and reported that more complex information processing is exhibited by experienced teachers. One recent study of student learners reported that student ability and achievement were significantly related to their reports of their thinking while learning (Peterson, Swing, Stark and Waas, 1984). Certain cognitive activities such as elaboration of key concepts of thinking involving comparisons and decision-making were correlated with subsequent achievement.

Purpose of this Study

The major purpose of this study was to observe the learning behaviors of teachers selected by their school districts to attend a training institute to learn some new ways of teaching. The teachers expected to use these new ways of teaching themselves and also to conduct training for other teachers in their own districts.

This study attempted to answer four questions.

1. What level of performance skill do teachers achieve with a teacher-centred model of instruction, Concept Attainment, and with a student-centred model of instruction, Synectics?

2. What general metacognitive efforts to learn do teachers exhibit in their teaching situations?

3. What cognitive behaviors do teachers reveal as they learn to use two new models of teaching?

4. Is there a difference in the behaviors of teachers who learn to use the new models successfully and those who do not do so?

Methods and Data Sources

This multi-variate descriptive study examined the behaviors and thinking of 12 in-service teachers from varied grade level and five school districts, as they learned and practised two new models of teaching in a two-week training situation, and then as they performed the same models in their classroom situation over an eight-month period. The frequency with which teachers used the two models, their performance skill and thinking about their use of the models were explored during three periods of data collection, one during training and two in their classroom situation.

Teacher skill in performance of the concept attainment and synectics models was measured using a rating scale to assess the fidelity of teacher performance to the steps of the model as it was taught (inter-observer reliability .93 for concept attainment and .94 for synectics).

Several measures were used to record teachers efforts to use the new models of teaching. Teacher practice logs recorded the number of times they used the new models of teaching in their classrooms and their feelings about the models. Anecdotal information from the recorded teacher interviews confirmed and supplemented the record in the teacher logs, and also provided information about their teaching situations and the contextual factors influencing their intentions and efforts to learn, adopt and use the new models of teaching.

The major data collection instrument was a semi-structured stimulated recall interview in which teachers viewed a videotape of a lesson they had taught and recorded their thoughts relating to the

lesson. In the analysis of these reports of teacher thinking an information-processing approach was used to identify and measure the teachers' cognitive behaviors. A short unit of thought, a cognition was identified, and each cognition was then coded in two separate analyses.

The first analysis identified thoughts teachers had during the lesson, interactive thoughts, and thoughts they had about their use of the model after the lesson, retro-active thoughts (inter-rater reliability .97).

The second analysis of teacher thoughts was based on cognitions associated with the verbal-declarative and procedural learning stages hypothesized by J.R. Anderson (1983) (inter-rater reliability .83 and .84). A detailed manual was developed describing sub-categories for coding teacher cognitions into two main categories:

(i) declarative knowledge, which includes understanding of goals and objectives of the model, and information and instructions on how to use it.

(ii) procedural knowledge, which includes conditions in the class and instructional actions and plans during use of the model.

Two personal variables, conceptual level and growth state scores, were also collected for each teacher.

Findings of the Study

Twelve teachers participated in this study. Two teachers had previous training and practice using the two models of teaching and ten teachers had no previous experience. One of the experienced teachers consistently demonstrated a much higher skill level with the models. The results reported here will focus on the group of ten teachers who

were learning the models for the first time. Brief case-histories describing the behaviors of three of these teachers will be compared with the experienced teacher who demonstrated expert level of performance skill in use of the models.

General Findings

The average skill level shown by the ten teachers during training, in July, and in their classrooms, in October and February, is shown in table 1.

Table 1. Performance skill level of teachers.

	July	October	February
Concept Attainment			
Group score $\bar{X}$	41	36	34
S.D.	7	7	13
Synectics			
Group score $\bar{X}$	46	44	51
S.D.	16	12	13

The group of ten teachers showed a slight decline in performance skill for the concept attainment model over the eight-month period, but the standard deviation increased as two teachers showed improvement, three performed poorly in October but improved again in February and five showed quite dramatic decreases in the level of their performance.

The teachers showed more improvement in their skill with the synectics model. Six teachers showed some improvement in skill, while two teachers maintained their skill level and only two showed a decline in skill over this period.

The experienced teacher demonstrated skill level for both models at two standard deviations above the group average for teachers just learning concept attainment and synectics.

In performance of both models teachers left out phases, but in the teacher-centred concept attainment model (which more closely resembles recitation teaching) these teachers did not appear to learn the steps of the new model so carefully. In the student-centred synectics model teachers appear to have paid more attention to following the complex phases of the model, and as the students became familiar with the model they may have influenced the performance scores recorded for the teachers.

Examination of teachers' efforts to learn and analysis of their thoughts about the models reveal additional insight into the differences in performance skill with these two models.

Teachers' efforts to learn to use these models of teaching are indicated in part by their practice of the models in their classrooms. All the teachers made a commitment to practice in anticipation of acting as trainers in their school districts.

The amount of practice (number of concept attainment or synectics lessons) reported by the teachers is shown in table 2.

Table 2. Amount of practice with new models from September to February

Teacher	Concept Attainment	Synectics
103	70	19
104	80	20
105	70	25
106	27	3
107	15	16
108	0	4
109	8	6
110	3	5
111	8	2
112	0	5

Only four or these teachers practiced both models 15 times or more over the six school months of the study. The amount of practice was not always related to the performance skill of the teacher. A correlation reported in detail (Dalton, 1986) showed a significant correlation between practice and skill level for concept attainment, and between teachers' growth state and practice for synectics.

Teachers 103 to 106 all showed improvement or skill maintenance with both models while the other six teachers showed a very varied pattern of skill and practice. Teacher logs and interviews revealed that there was no apparent relationship between the perceived usefulness of the model, the reported feelings of comfort in use of the models, and the amount the teachers used the models in their classroom. Detailed analysis of teacher thoughts clarified this aspect of teachers' intentions to learn in that some who reported discomfort made distinct efforts to learn about the models and others who felt very comfortable using the models performed at a very low skill level (Dodd, 1985).

Anecdotal interview information revealed that of the four teachers who practised both models frequently and maintained their skill levels or showed improved skill, three worked in school situations which supported their intentions to learn. Two of the teachers observed each other using the models and worked together to provide training for other school faculty members. The other teacher was encouraged by the principal to demonstrate the models for colleagues to observe in faculty meetings and in the classroom.

Interview data also revealed that these teachers did not use the coaching and feedback forms used in training and recommended for

them in their classroom practice and coaching situations. The teachers also said that they did not go back to the text describing the models to gain a better understanding of these new teaching skills, although they frequently said they were not sure about the goals and procedures of the models.

The cognitive behaviors teachers revealed were analyzed using a short cognition as the unit of thought to facilitate quantitative measures of two dimensions of teacher thinking.

Teacher style of thinking about their lessons is examined in the first analysis. The number of thoughts teachers recalled and reported from during the lesson, interactive cognitions, gives some indication of the concentration of teachers on the new classroom situation. The number of thoughts teachers report as they watch the videotape of their lesson, retroactive cognitions, gives an indication of the extent to which they are reflecting upon the lesson. The balance of their thoughts were partial cognitions, termed fragments.

The group results of the analysis of teacher interview transcripts are shown in table 3.

Table 3. Teacher's style of thinking about their lessons: percentages of interactive and retroactive cognitions.

	Interactive			Retroactive		
	July	Oct.	Feb.	July	Oct.	Feb.
Concept Attainment						
Group result $\bar{X}$%	27	26	23	56	65	65
S.D.	20	16	18	22	17	19
Synectics						
Group score $\bar{X}$%	29	23	25	66	69	61
S.D.	17	18	19	17	17	17

Examination of these results show that there is little difference in overall style of thinking about the two different models for the ten teachers as a group, but there is a wide variation in the style of thinking among individual teachers. This will be discussed further in the case studies to follow. Most teachers reported a higher percentage of retroactive thoughts as they related information about the class and reflected upon what they had done and could do another time.

The experienced teacher revealed a pattern of more interactive thoughts than the group for both models, but significantly more for the synectics model, which might be expected for this complex model with a series of quite different phases.

This analysis proved useful in showing that teachers could recall and did report a considerable number of their thoughts during the lesson. However, this analysis alone did not indicate whether these thoughts were related to learning to use the new models of teaching or were just about the class in general.

Teachers' thoughts related to learning or model-relevant thoughts were analyzed using the declarative and procedural categories developed from Anderson's hypothesized stages of learning a complex cognitive skill. This analysis provided a quantitative comparison of the thoughts of the teachers about learning to teach in new ways and also allowed comparison of the quality of thoughts teachers reported.

The declarative cognitions reported give some indication of the teachers' efforts to understand the goals of the model and follow instructions and rules remembered from reading and demonstration in the training period. The procedural cognitions reported indicate the

extent to which teachers are focussing on the instructional steps in the classroom, evaluating the lesson and generating alternative plans for using the model another time. The balance of cognitions in this analysis is other cognitions not directly related to the lesson, such as anecdotes about the students and humorous comments.

The percentages of thoughts related to learning to use the models that teachers reported is shown in table 4.

Table 4. Percentage of model-relevant declarative and procedural cognitions reported by the teachers.

	Declarative			Procedural		
	July	Oct.	Feb.	July	Oct.	Feb.
Concept Attainment						
Group result $\bar{X}$%	12	14	24	45	49	40
S.D.	9	9	11	12	10	12
Synectics						
Group score $\bar{X}$%	29	23	25	43	51	49
S.D.	11	10	10	16	24	14

Examination of this table of results indicates that the teachers, as a group, gave little attention initially to understanding the concept attainment model, which more closely resembles recitation teaching than the synectics model, but they did give considerable attention to understanding the rules and goals of the synectics model. This may help to explain the lower skill levels teachers achieved for the concept attainment model. For both models, most teachers reported more thoughts about instructional procedures in the classroom than about goals and training information received but there was quite wide variation in the teachers within the group.

The other cognitions, unrelated to learning the model, varied from a low of 11% to a high of 51%. Slightly more other cognitions were reported for concept attainment, but the variation in reports was greater for synectics. Individual teachers tended to show rather uniform profiles in percentage of model-relevant and other cognitions reported, as will be described in the case-histories.

The experienced teacher revealed very similar percentages of cognitions related to learning the models except for a high initial count of declarative cognitions during the repeated training in the concept attainment model as he reviewed his understanding of the model.

Case Studies

Four brief case studies are presented to illustrate in more detail the general efforts to learn and the cognitive behaviors displayed by four of these teachers who learned to use these models of teaching with different degrees of success.

Teacher 101, Randy

Randy was the most skillful teacher in the sample with both strategies, with a performance score of 63% for concept attainment and 75% for synectics. He had received previous training in use of both models and taken part in a study of the effects of coaching on teacher transfer of training. Randy reported more interactive cognitions than the group of teachers for both models as he was clearly conscious of and comfortable with relating the thoughts he had while teaching his classes. His reports of cognitions related to learning the models were

very similar to the group percentages with a profile of 15% declarative cognitions and 47% procedural cognitions for the two models.

Randy took part in training and coaching other teachers in use of the models. He took a lively interest in his middle school students and how they learned, and demonstrated sustained intention to learn these models of teaching himself. He appeared to most nearly represent the expert teacher in this group of potential teacher trainers, after three years exposure to training and practice with the models of teaching.

Teacher 103, Lara

Lara appears from this study to be an unusually conscientious and critical teacher, interested in learning to use the new models of teacher and pro-active in establishing a training program in her own school.

Lara practised the models frequently with a colleague/coach and achieved improvement in skill with both models over the period of classroom practice reaching skill scores of 46% and 52%, well above the group mean score for concept attainment. From the start of the study Lara reported a much higher percentage of interactive cognitions, reporting clearly what she had been thinking while teaching but also reflecting on her teaching afterwards. She frequently expressed uncertainty about her understanding of the models and made many suggestions related to decisions and plans to change the lessons another time. Her focus on learning was made clear as she reported an unusually high number of declarative cognitions for synectics as she struggled to understand the model, and only 20% of other cognitions (unrelated to learning), compared to the group average of 34%.

Lara was striving to become an expert in performance of these models, but did not use the coaching outline and expressed the need for further help in understanding the models, and in generating routines to facilitate her performance of the models with her primary class.

Teacher 106, Cory

Cory emerged during this study as one of the most skillful teachers in using both models, scoring an average of 46% and 61% for concept attainment and synectics respectively, with both scores being one standard deviation above the mean for the group.

Cory appeared from the start of the training to be a confident teacher revealing a high percentage of model-relevant cognitions. His style of thinking closely resembled the group mean for concept attainment but he reported a higher percentage of interactive cognitions for synectics, which he clearly found challenging and although he only practised it twice, he was the only teacher in the study to initiate some new classroom routines in the performance of the synectics model.

Cory's intentions to learn were confounded somewhat by his involvement in some curriculum development in his district, and the other teacher from the training institute did not work with him for coaching as intended. His thoughts related to learning the model showed a higher than average percentage of declarative cognitions as he strove to understand the models he was teaching and also a higher percentage of cognitions about instructional procedures.

Cory appears to have the potential for achieving an expert level of skill in these two models and has already demonstrated

considerable skill without frequent practice or coaching. Close examination of his lessons reveals that coaching by an informed coach could probably help him achieve consistently expert performance scores quite quickly.

Teacher 111, Dean

Dean was one of the most enthusiastic teachers when talking about the models in this study. He felt very comfortable with the models and was very interested in the lesson content he was developing for his high school students.

Dean's interest did not translate into finding time to practise the models often, in part because he was a school administrator. Dean's skill level for concept attainment declined from 42% in training to 23% in his classroom in spite of reported practice in eight lessons. Like Cory, Dean was able to show remarkable improvement in performance of synectics from 31% in training to 50% in the February class, with only two practice lessons.

Analysis of Dean's cognitions during the stimulated recall interviews showed a profile of only 17% interactive cognitions and 76% retroactive cognitions. Detailed examination of these showed that he reported one of the highest percentages of cognitions unrelated to learning, 41%. He reported only 4% declarative cognitions about the goals of concept attainment, but an average percentage of procedural cognitions for this model, for which his skill score was very low. However, Dean reported a high 33% of declarative cognitions about synectics, for which he had a much improved final skill score.

Dean's case study makes clear some interesting points about a teacher learning well and failing to learn a new teaching skill.

Clearly practice alone is not enough, and Dean did not receive any coaching, nor did he focus a high percentage of his thoughts on aspects of learning to use the models. Dean apparently failed to develop initial understanding of concept attainment but did address this aspect of synectics. In spite of his low skill level Dean had presented a workshop for teachers in his district, where he was regarded as an excellent high school teacher.

Discussion

This study provides an interesting picture of the marked variation in the efforts and success of teachers in learning to use new models of teaching. All the teachers were sponsored by their school districts to attend a training institute, so that they might act as trainers or resource persons in their districts. Five of the ten teachers just learning the models did act as trainers although the skill they demonstrated with the models was very varied.

As the general findings and case studies indicate, the teachers who made clear efforts to learn to use the models either showed evidence of their intention during the training period in the quality of their thoughts related to learning, and/or worked in a school situation which consistently provided support and incentive to use their new skills. These teachers generally showed improved performance of the models of teaching, but their skill appeared to be limited by lack of clear understanding of the models and incomplete memory of the instructional procedures involved. Some of the teachers did indicate their need for on-going instruction and discussion about their use of the models, and

some asked for help in developing routines to facilitate use of the models in their classes.

These findings challenge one of the major assumptions held by teacher educators and school district personnel. That assumption is that in-service teachers are willing and able to learn new skills during training institutes, graduate courses and teacher workshops and then transfer these skills to their classroom. Showers (1983) documented the failure of many teachers to achieve vertical transfer of training to their classrooms. In this study, only one of the two teachers who had used the models for three years performed consistently at a skill level which might be considered expert.

It appears that learning to use new models of teaching does indeed require teachers to learn a complex new cognitive skill. Fredericksen (1984) reviewed cognitive theories and their implication for problem-solving and suggested that Anderson's comprehensive theory of problem-solving described a widely used learning process. It does appear to have provided a useful framework for analysis of teacher thoughts, which Dodd (1985) describes in some detail.

The ways in which more successful learners focussed on both the understanding of the models and the instructional procedures was quantitatively and qualitatively different from the thoughts of less successful learners. Less successful learners frequently described their classes, their preferred teaching styles and routines and their feelings and attitudes to teaching. These were sometimes in conflict with the behaviors required in the new models of teaching, but these

conflicts were never resolved in the training and practice situations experienced.

This suggests that the teacher training model consisting of theory, demonstration, practice with feedback and coaching does not fully address the needs of teachers for opportunity to explore their own practical reasoning (Clark and Yinger, 1987). Although this small sample of teachers cannot be used to generalize the findings widely, these teachers were selected simply by geographic location from a large number of teachers at the training institute and did appear to represent the wider population of teachers quite well as indicated by similar log records and anecdotal information about other teachers who attended the institute.

These teachers demonstrated the ability to reflect on themselves and their teaching but they did not all do this frequently enough or in the most productive manner. The failure of teachers to seek out coaching and to review their own knowledge and performance critically (although this was stressed in the training institute) apparently had the result that none of the ten potential trainers achieved a consistent expert skill level in this time period with the two new models of teaching. These models did require a considerable change in teacher behavior and thinking, and some teachers acknowledged their limited understanding of the models, while others moved towards rejecting the models for reasons of personal preferred teaching style and failure to see the relevance of the models for them.

It is encouraging that teachers are willing to spend time and energy learning new teaching skills, some with considerable success.

It is disappointing, and wasteful in many respects, that some teachers who demonstrated willingness to attend a training institute to learn new models of teaching could not fulfill their initial intentions to learn for a variety of personal and contextual reasons.

Teaching is a demanding career. Good teaching requires creative energy, and learning new skills also requires a considerable commitment of time and energy. The findings of this study suggest that teacher educators and teachers themselves need to be much more aware of the time and effort needed for successful learning and implementation of new skills. They also need to recognize the importance of teacher beliefs, school support systems and the cognitive activity of teachers as they participate in interventions requiring active learning of new teaching skills.

This study of teacher thinking also showed that teachers can generate more thoughts about objectives and instructional procedures of classroom teaching than has been documented for most of the studies reviewed by Clark and Peterson (1986). In fact Anderson predicts that as learners become expert and proceduralise cognitive skills, their thoughts become automatic and less easily recalled, which may be the case in studies of teachers using the recitation mode. In recitation lessons fine-tuning teaching skills is all that is needed, and less is remarkable or worthy of comment because it is so familiar.

Future research might explore cognitive behaviors of teachers as they learn to teach using models of systematically differing complexity which might form part of a teaching repertoire perceived as useful by the teachers. Preliminary findings of a current research project

suggest some workshop components that help teachers see the usefulness of the model and allay their fears about learning it themselves.

Research into the potential of the stimulated recall procedure for raising awareness of metacognitive activity could be further explored. Most teachers in this study enjoyed the experience and found it helpful, and willingness to participate in such a time-consuming process is some indication of their intention and willingness to learn. Teachers rarely have opportunity to talk about their own teaching in detail. The categories developed from Anderson' theory appear to provide a useful analytical framework for teachers in guiding reflection about their own teaching as they learn new skills to increase their teaching repertoire.

The power of reflection in learning has long been understood, but sometimes neglected. Dewey's use of the term reflection, meaning problem-solving, is interpreted by Clark and Yinger (1987). The theoretical basis of analysis for this study seems to be a possible vehicle for helping teachers gain a clearer understanding of the links between their own thinking and behavior, and their teaching performance of new and desirable teaching skills may be enhanced as a result. In addition, perhaps the behaviors exhibited by more successful teacher-learners can be taught to other teachers.

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